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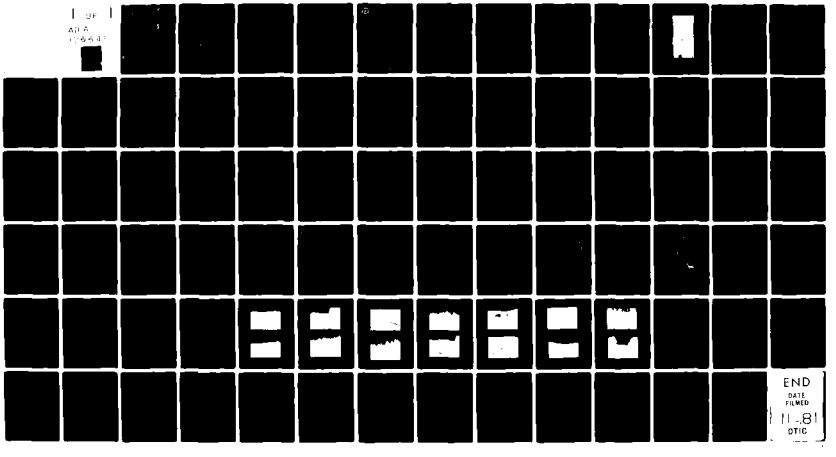

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MO. NO NAME NO. 258 DAM
JEFFERSON COUNTY, MISSOURI
MO. 30455

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
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St. Louis District

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PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

JULY 1981

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4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Mo. No Name No. 258 Dam (MO 30455) Jefferson County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.		8. CONTRACT OR GRANT NUMBER(s) DACW43-81-C-0063
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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National Dam Safety Program. No Name [redacted] (MO 30455), Mississippi - Kaskaskia - St. Louis Basin, Jefferson County, Missouri. Phase I Inspection Report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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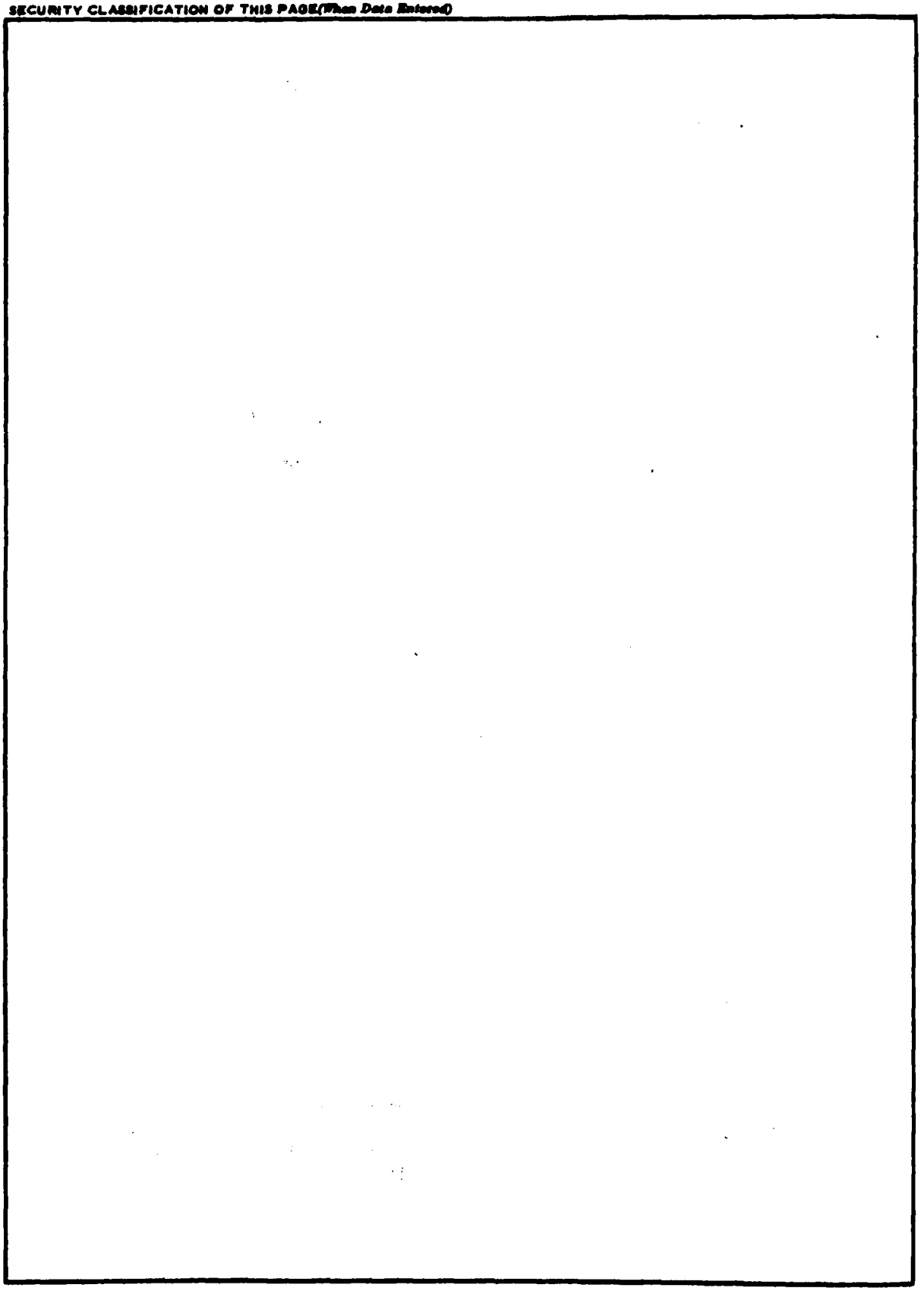

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Mo. No Name No. 258 Dam (Mo. 30455) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Mo. No Name No. 258 Dam (Mo. 30455).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

a. The spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

b. Overtopping of the dam could result in failure of the dam.

c. Dam failure significantly increases the hazard to loss of life downstream.

SIGNED

SUBMITTED BY: _____ 21 JUL 1981
Chief, Engineering Division — Date

SIGNED

APPROVED BY: _____ 22 JUL 1981
Colonel, CE, Commanding — Date

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MO. NO NAME NO. 258 DAM
JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30455

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
PRC CONSOER TOWNSEND, INC.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

JULY 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Mo. No Name No. 258 Dam,
Missouri Inventory No. 30455
State Located: Missouri
County Located: Jefferson
Stream: Unnamed tributary of the Big River
Date of Inspection: March 5, 1981

Assessment of General Condition

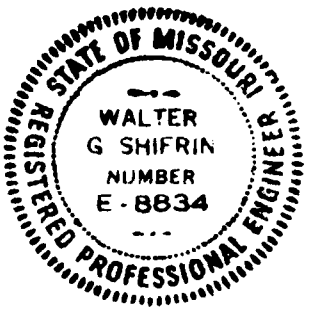
Mo. No Name No. 258 Dam was inspected by the engineering firms of PRC Consoer Townsend, Inc. of St. Louis, Missouri, and PRC Engineering Consultants, Inc. of Englewood, Colorado, (A Joint Venture) in accordance with the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Located within the estimated damage zone of two miles downstream of the dam are at least eleven dwellings, two buildings, and a state highway crossing (Highway 21) which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Mo. No Name No. 258 Dam is in the small size classification since it is 35.3 feet high and has a maximum reservior impoundment of 120 acre-feet.

The inspection and evaluation indicate that the spillway of Mo. No Name No. 258 Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Mo. No Name No. 258 Dam being a small size dam with a high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping the dam. Considering the possibility of loss of life and the destruction of property downstream of the dam, the PMF is considered the appropriate spillway design flood for Mo. No Name No. 258 Dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. It was determined that the reservoir/spillway system can accommodate approximately 20 percent of the Probable Maximum Flood without overtopping the dam. The evaluation also indicates that the reservoir/spillway system can accommodate the one-percent chance flood (100-year flood) without overtopping the dam.

The overall condition of the dam and the spillway appears to be fair; however, several deficiencies were noted by the inspection team. The deficiencies included: the large fill material obstruction in the spillway channel; the configuration of the spillway crest; the erosion observed in the spillway approach apron; the erosion gully, trees and brush observed in the spillway discharge channel; the damage to the embankment caused by vehicular traffic; the trees and brush growing on the embankment slopes; the presence of rodent burrows on the downstream slope; the means in which the gate valve of the low-level outlet was concealed; a need for periodical maintenance of the grass cover on the embankment and a lack of a maintenance schedule; and there also exists a need for periodic inspection by a qualified engineer. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.



Overview of Mo. No Name No. 258 Dam

NATIONAL DAM SAFETY PROGRAM

MO. NO NAME NO. 258 DAM, I.D. No. 30455

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

MO. NO NAME NO. 258 DAM, Missouri Inv. No. 30455

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Mo. No Name No. 258 Dam was carried out under Contract DACW 43-81-C-0063 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of PRC Consoer Townsend, Inc., of St. Louis, Missouri and PRC Engineering Consultants, Inc. of Englewood, Colorado, (A Joint Venture).

b. Purpose of Inspection

The visual inspection of Mo. No Name No. 258 Dam was made on March 5, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site and of the structural adequacy of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the northeast abutment or side, and right to the southwest abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase I Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following is based upon observations and measurements made during the visual inspection. No design or "as-built" drawings for the dam or appurtenant structures were available.

The dam is an earthfill structure placed between earth abutments with an alignment that is curved in the downstream direction. A plan and elevation of the dam are shown on Plate 3 and Photos 1 through 3 show views of the dam. The top of dam has a length of 625 feet between the left abutment and the spillway and an assumed minimum elevation of 760.0 feet above mean sea level (M.S.L.). The minimum top of dam elevation was measured to be at a point 300 feet from the left abutment. From this point, the top of dam slopes upward at various degrees to both ends of the dam with a rise in elevation of 3.3 feet and 2.2 feet at the left and right sides, respectively. The embankment has a top width of nine feet and a maximum structural height of 35.3 feet. The downstream slope was measured to be 1 vertical to 2.25 horizontal (1V to 2.25H). A 15-feet wide berm was constructed on the upstream slope with a top elevation of 747.6 and 746.0 feet above M.S.L. at the downstream and upstream edges, respectively. The upstream embankment slope above the berm and below the berm to the water surface was measured to be 1V to 4H .

There is only one spillway at this damsite which consists of a grass-covered, earth- and weathered bedrock-lined channel cut into the right abutment. An access road crosses the spillway approach apron upstream of the spillway crest. The inlet of the spillway is defined by the upstream end of a concrete retaining wall on the left side of the channel (see Photo 6). The wall is 12-inches thick, three feet high and 50-feet long. Two, one-half inch diameter, reinforcing bars spaced 24 inches apart are protruding from the top of the wall near the upstream end. Further reinforcement of the wall is not known. The wall protects the dam embankment from flows through the spillway. The wall is perpendicular to the axis of the dam at the spillway crest. Downstream of the spillway crest, the wall slopes down and curves slightly toward the downstream channel. The right side slope of the channel is grass-lined with occasional outcrops of weathered bedrock (see Photo 6). The bottom of the channel at the spillway crest is lined with weathered bedrock. The channel at the spillway crest is 19-feet wide with a

minimum invert elevation of 757.2 feet above M.S.L. The left side of the spillway crest is 0.4 feet lower than the right side. Downstream of the crest, the channel converges into a triangular shaped, control section, which has an earth and weathered bedrock lining (see Photo 7). As the channel proceeds beyond the control section and toward the downstream channel, the shape becomes trapezoidal and the bottom remains lined with weathered bedrock. Flow from the spillway enters the downstream channel slightly below the toe of the embankment.

A low-level outlet is provided at the dam. A vertical, perforated steel, riser pipe is located near the upstream toe of the embankment 289 feet from the left abutment (see Photo 9). The riser appears to be six inches in diameter and the height is unknown. A six-inch diameter steel outlet pipe is located at the downstream toe of the embankment 312 feet from the left abutment (see Photo 10). The location of the valve that controls the drawdown is unknown; however, a metal valve operator was found about 30 feet upstream of the outlet, partially buried in the embankment. It is assumed that the valve was also located near this point. The outlet pipe discharges into an earth-lined channel which leads directly into the downstream channel.

b. Location

Mo. No Name No. 258 Dam is located in Jefferson County in the State of Missouri on an unnamed tributary of the Big River. The location of the dam on the 7.5 minute series of the U.S. Geological Survey maps is found in the northeast quadrant of Section 18 of Township 39 North, Range 4 East, of the Vineland, Missouri Quadrangle Sheet (Advance Print, see Plate 2). The dam is also located approximately four miles southwest of De Soto and nine miles southwest of Hillsboro (see Plate 1). The axis of the dam is situated approximately parallel to and 175 feet northwest of State Highway 21.

c. Size Classification

The reservoir impoundment of Mo. No Name No. 258 Dam is less than 1,000 acre-feet but more than 50 acre-feet, which would classify it as a "small" size dam. The maximum height of the dam is less than 40 feet and greater than 25 feet, which also classifies it as a "small" size dam. The size classification is determined by either the storage or height, whichever gives the larger size category. Therefore, the size classification is determined to fall within the "small" category, according to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. From a visual inspection of the downstream area, our findings concur with this classification. Located within the estimated damage zone, which extends approximately two miles downstream of the dam, are at least eleven dwellings, two buildings, and a state highway crossing (Highway 21) (see Photos 13 and 14).

e. Ownership

Mo. No Name No. 258 Dam is privately owned by a partnership. The partners are Mr. and Mrs. Robert E. Vogler and Mr. John Kostyshock. The mailing addresses are Mr. and Mrs. Robert E. Vogler, 1630 Fair Hills, Creve Coeur, Missouri, 63141 and Mr. John Kostyshock, 4958 Tholozan Avenue, St. Louis, Missouri, 63109. The owners requested that the dam should not be named after them and that the state designated name be retained for the dam.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use as a private lake.

g. Design and Construction History

Mr. and Mrs. Vogler and Mr. Kostyshock were not the owners of the dam when it was built. According to Mr. Vogler, the dam was built prior to 1948 as shown by a survey plat of the area, which was dated in 1948. Mrs. Barbara Widmann, the previous owner of the dam property, did not know when or by whom the dam was built.

There are no design drawings or specifications for the dam. No modifications have been made at the damsite since the original construction of the dam.

h. Normal Operational Procedures

The dam is used to impound water for recreational use. There are no operational procedures which are followed for the operation of Mo. No Name No. 258 Dam. The lake level is normally allowed to remain as full as possible with the water level below the elevation of the spillway crest being controlled by rainfall, runoff, evaporation, and the operation of the low-level outlet.

1.3 Pertinent Data

a. Drainage Area (square miles): 0.28

b. Discharge at Damsite

Estimated experienced maximum flood (cfs): . . . . . Unknown

Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs): 180

c. Elevation (Feet above MSL)

Top of dam (minimum):. . . . . 760.0 (assumed)*

Spillway crest:. . . . . 757.2 (minimum)

Normal Pool: 757.2

Maximum Experienced Pool:. . . . . Unknown

Observed Pool: 739.0

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):. 1600

e. Storage (Acre-Feet)

Top of dam (minimum):. 120

Spillway crest:. 80

Normal Pool: 80

Maximum Experienced Pool:. . . . . Unknown

Observed Pool: 4.5

f. Reservoir Surfaces (Acres)

Top of dam (minimum):. 21.5

Spillway Crest:. 8.5

Normal Pool: 8.5

Maximum Experienced Pool:. . . . . Unknown

Observed Pool: 1.5

g. Dam

Type:	Earthfill
Length:	625 feet
Structural Height:	35.3 feet
Hydraulic Height**:	35.3 feet
Top width:	9 feet
Side slopes:	
Downstream.	1V to 2.25H (measured)
Upstream.	1V to 4H (above the berm and below the berm to the water surface)
Zoning:	Unknown
Impervious core:	Unknown
Cutoff:	Unknown
Grout curtain:	Unknown
Volume:	65,500 cu. yds. (estimated)

h. Diversion and Regulating Tunnel. . . . . None

i. Spillway

Type:	Earth- and rock-cut channel, uncontrolled
Location:	Right abutment
Length of crest:	19 feet
Crest Elevation (feet above MSL):	757.2 (minimum)

j. Regulating Outlets

Type:	Low-level outlet consisting of a six-inch diameter perforated vertical steel riser inlet pipe connected to a six-inch diameter steel outlet pipe.
Location:	The inlet pipe is situated at the upstream heel of the embankment 289 feet to the right

	of the left abutment. The outlet pipe travels through the embankment and exits at the downstream embankment toe 312 feet to the right of the left abutment.
Length:	Unknown
Closure:	A valve (Assumed to be a Gate Valve)
Maximum Capacity:	Unknown

* No exact elevation is known for the top of dam, therefore, an elevation was estimated from the Vineland, Missouri, U.S.G.S. Quadrangle sheet, Advance Print. This estimated elevation is referred to as an assumed elevation. All other elevations were determined from the assumed top of dam elevation and field measurements.

** The hydraulic height of the dam is the vertical distance from the lowest point on the downstream toe to the top of dam or the maximum water surface, if below the top of dam.

SECTION 2: ENGINEERING DATA

2.1 Design

No design drawings or data are available for the dam.

2.2 Construction

No data is available relative to the construction of the dam.

2.3 Operation

No operational records or data are available for the dam.

2.4 Evaluation

a. Availability

The availability of engineering data is poor and consists only of the State Geological Maps, a general soil map of the State of Missouri published by the Soil Conservation Service, and U.S.G.S. Quadrangle Sheets.

b. Adequacy

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance history, and present condition of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These

seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

No valid engineering data pertaining to the design or construction of the dam were available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Mo. No Name No. 258 Dam was made on March 5, 1981. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Soils
Jerry Kenny	PRC Engineering Consultants, Inc.	Hydraulics and Hydrology
James Nettum, P.E.	PRC Engineering Consultants, Inc.	Civil-Structural and Mechanical
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
John Lauth, P.E.	PRC Consoer Townsend, Inc.	Civil-Structural

Specific observations are discussed below.

b. Dam

The overall condition of the dam appears to be fair; however, some items of concern were observed and are described below.

The top of dam is occasionally used as an access road (see Photo 2). Damage to the embankment due to vehicular traffic was seen in several locations. The access road travels up the upstream slope near the spillway inlet (see Photo 8). The traffic in this area has worn the grass cover off of the slope leaving the slope unprotected. Further damage to the upstream slope was seen on top of the berm where several deep tire ruts were observed (see Photo 4). Damage to the top of dam was also observed. The difference in elevation between the two paths created by vehicular traffic across the dam varied from no difference to one-foot in one area.

The top of dam supports a good grass cover outside of the two paths of the access road. The grass cover appears to provide adequate protection against erosion due to surface runoff. No major depressions or cracks indicating a settlement of the embankment were observed. The variation in elevation across the top of dam did not appear to be due to an instability of the embankment. No significant deviation in the horizontal alignment was apparent except for the curvature in the dam axis; however, the dam appears to have been constructed this way. No evidence indicating that the dam has ever been overtopped was observed.

Due to the water level in the reservoir on the day of the inspection, a comprehensive inspection of the upstream slope was achieved. No riprap protection was provided on the slope; however, only very minor erosion due to wave action was seen on the slope at the assumed normal water surface level. The slope above the normal water surface level was adequately protected against erosion due to surface runoff by a good, unmaintained grass cover. Several small

trees were also observed at the normal water surface level (see Photo 1). The vegetation on the slope below the normal pool elevation would indicate that reservoir level has been below the normal pool elevation most of the time in recent years. No bulges, depressions or cracks indicating an instability of the embankment or foundation were observed on the slope. The effect of drawing down the reservoir by the low-level outlet has had no apparent effect on the stability of the embankment. Four, two-inch grout cap pipes were observed on the top of the berm (see Photo 4); however, the pipes, according to Mr. Vogler, have never been used.

The downstream slope of the dam appears to be adequately protected from surface runoff erosion by an unmaintained grass cover. Large vegetation ranging from brush to medium sized trees was also observed on the slope. Some shallow surface sloughs on the slope and one large slough along the toe of the embankment were observed. The sloughs were overgrown with vegetation and appeared to be inactive. No depressions, bulges or cracks indicative of a slope movement were apparent on the slope. No seepage was observed on the slope or along the downstream toe of the dam; however, due to the water surface level in the reservoir on the day of the inspection, it is highly unlikely that any seepage through the embankment or foundation could be detected.

Both abutments slope gently upward from the dam. No instabilities or seepage were observed on either abutment. Some erosion was on the right abutment upstream of the spillway inlet and in the discharge channel of the spillway. Nevertheless, the erosion did not appear to have any effect on the stability of the abutment or the dam. No erosional problems were observed on the left abutment.

Rodent burrows up to four inches in diameter were observed in several places on the downstream slope (see Photo 5). No evidence of burrowing animals was apparent on either abutment or the remaining portion of the dam.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of the Big River in the Salem Plateau section of the Ozark Plateaus Physiographic Province. Deep dissection of topography by major streams is one of the important characteristics of the Salem Plateau section. There is a wide distribution of dolomites and limestones in the Salem Plateau. Cuestaform topography is exhibited in this plateau section consisting of two major escarpments, namely the Crystal Escarpment and Burlington Escarpment. Deep dissection in dolomites and limestones is a major factor in the development of many springs in this area.

The topography in the vicinity of the damsite is rolling to hilly with U- to V-shaped valleys. Elevations of the ground surface range from 884.0 feet above M.S.L. nearly 1.7 miles south of the damsite to 760.0 feet above M.S.L. at the damsite. The reservoir slopes are generally from ten- to twenty-degrees from horizontal. The reservoir slopes are stable and the reservoir appears to be watertight. The area near the damsite is covered with residual soil deposits consisting of a reddish-brown, moderately plastic, silty clay with occasional rock fragments.

The regional bedrock geology beneath the residual soil deposits in the damsite area as shown on the Geologic Map of Missouri (1979) (see Plate 5) are of the Ordovician age rocks consisting of Decorah Formation, St. Peter Sandstone, Powell Dolomite, Cotter Dolomite, Roubidoux Formation, and Gasconade Dolomite; and the Cambrian age rocks consisting of Eminence Dolomite, Potosi Dolomite, and Franconia and Bonneterre Formations. The predominent bedrock underlying the residual soil deposits in the vicinity of the damsite are the Ordovician age rocks consisting of Powell Dolomite, Roubidoux Formation, Gasconade Dolomite and St. Peter Sandstone.

Outcroppings of Ordovician Powell Dolomite (light brown, fine grained, hard, thinly bedded, slightly weathered dolomite) are exposed on the right and left abutments and in the discharge channel of the spillway (see Photos 6 and 11).

No faults have been identified at the damsite. The closest trace of a fault to the damsite is the Ste. Genevieve fault system nearly one mile southwest of the damsite. The Ste. Genevieve fault had its last movement in the post-Pennsylvanian time. Thus, the fault system has no effect on the damsite.

No boring logs or construction reports were available that would indicate foundation conditions encountered during construction. Based on the visual inspection, the embankment probably rests on Ordovician Powell Dolomite bedrock. The spillway was cut into the residual soils of the right abutment which overlays the thinly bedded dolomite bedrock. The low-level outlet pipe probably rests on the compacted embankment fill.

(2) Project Soils

According to the "Missouri General Soil Map and Soil Association Description" published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Union-Goss-Gasconade-Peridge in the Ozark Border Association. The soils are basically formed from loess deposits and weathered bedrock. These soils vary from a slowly permeable silty clay to moderately permeable silt loam.

Material removed from the embankment slopes was a medium brown and tan mottled, moderately plastic, silty clay with some fine sand and traces of rock fragments. Based upon the Unified Soil Classification System, the soil would probably be classified as a CL. This is an impervious soil type, which generally has the following characteristics: a coefficient of permeability less than one foot per year, medium shear strength, and a high resistance to piping.

d. Appurtenant Structures

(1) Spillway

The upstream end of the concrete retaining wall was not protected by riprap, but the thick grass covering of the embankment appears to have prevented any erosion in this area (see Photo 6). Some minor honeycombing of the wall was observed along with small amounts of talus resulting from popouts and spalling of the concrete. A small erosion scarp was observed where the access road proceeds from the spillway inlet apron up the embankment toward the top of the dam (see Photo 8).

The weathered bedrock lining of the spillway crest section appeared stable; however, the shape of the channel in this area has concentrated flow on the left side of the spillway. Although not currently evident, flow concentrated along the left side of the channel could accelerate erosion along the base of the retaining wall. About 30 feet downstream of the crest section, a large pile of what appears to be fill material was obstructing the left side of the spillway channel creating the triangular shaped control section (see Photo 7). Flow through the spillway impinges upon this pile, which in turn directs the flow toward the control section. This change in flow direction has caused an erosion scarp to form in the channel bottom at the base of the fill material (see Photo 7). This obstruction did not appear to have caused any serious damage to the dam at this time; however, it has reduced the capacity of the spillway by moving the control section of the spillway from the spillway crest to a much smaller section downstream. This could have serious safety ramifications in the future.

The spillway channel downstream of the control section was obstructed with numerous trees. An erosion gully has formed in the discharge channel downstream of the lowest extent of the bedrock outcropping in the channel. The channel is currently aligned such that the embankment is not endangered.

(2) Low-level Outlet

The inlet and outlet of the low-level outlet appeared unobstructed. No piping or erosion was evident around the outlet pipe. According to Mr. Vogler, the gate valve, which controls the system, is operable. He also stated that the valve has been locked and buried under soil to prevent vandals from draining the reservoir. The actual location of the valve was not found on the day of the inspection. Depending on the condition of the unseen control valve, the outlet should function properly.

e. Reservoir Area

The reservoir water surface elevation at the time of the inspection was 739.0 feet above M.S.L. The reservoir has a normal water surface elevation of 757.2 feet above M.S.L. and a surface area of 8.5 acres at the normal water surface level.

The rim appeared to be stable with no erosional or stability problems observed (see Photo 12). The land around the reservoir slopes gently upward from the reservoir rim and is mostly wooded. No houses are built in the reservoir area. No evidence of excessive siltation was observed in the reservoir on the day of the inspection.

f. Downstream Channel

The downstream channel is not well defined and is obstructed with trees from the dam embankment to the State Highway 21 embankment, which is located approximately 175 feet downstream of the dam. Discharges through the spillway of the dam pass under the highway through a six-feet high, eight-feet wide concrete box culvert.

3.2 Evaluation

The visual inspection uncovered nothing of a consequential nature which would require immediate remedial action. However, the following conditions were observed which could adversely affect the dam in the future.

1. The erosion in the spillway approach apron caused by vehicular traffic has not created a safety hazard to date. However, continual erosion in this area could affect the stability of the spillway retaining wall.

2. The horizontal deviation in the channel bottom of the spillway crest in itself is not a hazard to the safety of the dam due to the fairly durable lining of the channel. But, coupled with item 3 below, this configuration could lead to an unsafe condition.

3. The large fill material obstruction in the spillway channel does not appear to have previously imperiled the dam. But, the obstruction has been the cause of erosion in the spillway channel plus it severely reduces the capacity of the spillway. Large and prolonged flows through the obstructed spillway could jeopardize its stability and endanger the dam.

4. The erosion gully in the spillway discharge channel has not created a hazard to the dam to date. But, future flows through the spillway will aggravate this condition to a point where the safety of the dam could be jeopardized.

5. The damage to the embankment caused by vehicular traffic does not endanger the safety of the dam in its present condition. Nevertheless, continual aggravation of the dam in these areas can only be detrimental to the structural integrity of the dam.

6. The unmaintained vegetative cover on the embankment slopes, especially the trees, pose a potential danger to the safety of the dam if continued growth is allowed. A tall, dense growth of vegetation on the embankment hinders a comprehensive inspection of the dam and potential problems could go undetected. And, the root system of large trees present possible paths for piping through the embankment and can also do damage to the embankment by being uprooted during a storm.

7. The animal burrows observed on the downstream slope could jeopardize the safety of the dam. The holes created by the animals make avenues for possible piping.

8. The method in which the gate valve of the low-level outlet was concealed is not a recommended deterrent for vandals. The valve should be easily accessible in case the reservoir has to be lowered in an emergency.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Mo. No Name No. 258 Dam was built to impound water for recreational use. There are no specific operational procedures which are followed at this damsite. The lake is allowed to remain as full as possible with the water level below the spillway crest elevation being controlled by rainfall, runoff, evaporation, and the operation of the low-level outlet.

4.2 Maintenance of Dam

The maintenance of the dam appears to be inadequate. The downstream slope is covered with brush and trees. Several small trees are also growing on the upstream slope of the dam. Considerable damage has been caused to the embankment due to vehicular traffic. The spillway channel is also obstructed by a pile of fill material.

4.3 Maintenance of Operating Facilities

The six-inch diameter low-level outlet, which extends through the dam embankment, is the only operating facilities at the damsite. Mr. Vogler has buried and locked the gate valve in order to prevent vandals from draining the reservoir. Mr. Vogler indicated the gate valve is operable. The gate valve was not located on the day of the inspection.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the damsite, such as an electrical warning system or a manual notification plan.

4.5 Evaluation

The dam appears to be neglected and the maintenance is inadequate at this time. The corrective measures listed in Section 7 should be undertaken within a reasonable period of time to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No hydrologic and hydraulic design data are available for Mo. No Name No. 258 Dam. The sizes of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dam were prepared from field notes and sketches prepared during the field inspection. The reservoir elevation-area data were based on the U.S.G.S. Vineland and Tiff, Missouri Quadrangle topographic maps (Advance Prints, 7.5 minute series). The spillway and overtop release rates and the reservoir elevation-area data are presented in Appendix B.

The hydrologic soil group of the watershed was determined from information available in the U.S.D.A. Soil Conservation Service publication "Missouri General Soil Map and Soil Association Descriptions", 1979. The Probable Maximum Precipitation (PMP) used to determine the Probable Maximum Flood (PMF) was determined by using the U.S. Weather Bureau publication "Hydrometeorological Report No. 33" (April 1956). The 100-year and the 10-year floods were derived from the 100-year and the 10-year rainfall, respectively, of Sullivan, Missouri.

b. Experience Data

Records of reservoir stage or spillway discharge are not maintained for this site. However, no evidence was observed which would indicate that the embankment had ever been overtopped.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1d and evaluated in Section 3.2.

d. Overtopping Potential

Both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak inflows of the PMF and one-half of the PMF are 3,635 cfs and 1,817 cfs, respectively. The peak outflow discharges for the PMF and one-half of the PMF are 2,957 cfs and 1,233 cfs, respectively. The maximum capacity of the spillway just before overtopping the dam is 180 cfs. The PMF overtopped the dam by 2.11 feet and one-half of the PMF overtopped the dam by 1.38 feet. The total duration of flow over the dam is 6.58 hours during the occurrence of the PMF and 4.42 hours during one-half of the PMF. The spillway/reservoir system of Mo. No Name No. 258 Dam is capable of accommodating a flood equal to approximately 20 percent of the PMF just before overtopping the dam and will also accommodate the one-percent chance flood without overtopping the dam.

The surface soils on the embankment and in the spillway consist of a silty clay. The earthen portions of the spillway and the top and downstream slope of the dam have a good cover of grass. Nevertheless, the dam will be overtopped by over two feet during the occurrence of the PMF, which can cause severe erosion to the embankment due to the high velocity of flow on its downstream slope and could lead to the eventual failure of the dam. The maximum velocity of flow in the spillway channel during the PMF will be about nine ft/sec, which could cause excessive erosion in the earthen portions of the spillway channel. Excessive erosion in the spillway channel could jeopardize the safety of the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately two miles downstream of the dam. Located within the damage zone are at least eleven dwellings, two buildings, and a state highway crossing (Highway 21).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no major signs of settlement or distress observed on the embankment or foundation during the visual inspection. The stability of the dam embankment did not appear to be in jeopardy at this time; however, continual deterioration of the dam due to neglect and improper maintenance procedures can only be detrimental to the structural integrity of the dam in the future. The sloughs observed on the downstream slope would indicate that a partial failure of the slope in these areas has occurred in the past. However, the scarps have overgrown with vegetation, which would indicate that the sloughs occurred several years ago. The areas appear to have stabilized. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made.

The structural stability of the spillway appears to be endangered due mainly to the fill material obstruction, which severely restricts the capacity of the spillway. Discharge impinging upon the obstruction has caused some erosion in the spillway channel bottom. Also, the configuration of the crest section directs water to the left side of the spillway where accelerated erosion around the base of the retaining wall could take place.

b. Design and Construction Data

No design computations pertaining to the embankment were uncovered during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying

out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. The water level on the day of inspection was 18.2 feet below the crest of the spillway; however, the reservoir is assumed to remain close to full most of the time.

No evidence was observed that would indicate that the drawing down of the reservoir by the low-level outlet has had any effect on the structural stability of the dam. It is also felt that due to the small size of low-level outlet, the flatness of the upstream slope and the volume of water stored in the reservoir that drawing down the reservoir by means of the outlet should not have any effect on the stability of the dam.

d. Post Construction Changes

No post construction changes to the embankment are known to exist that will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 2, as defined in the "Recommended Guidelines for Safety Inspection of Dams" as prepared by the Corps of Engineers (see Plate 5). Seismic Zone 2 is characterized by a moderate earthquake hazard. An earthquake of the magnitude that would be expected in Seismic Zone 2 should not cause significant distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite. The maximum recorded historic magnitude earthquake in the immediate vicinity of the damsite was the January

24, 1902 event of magnitude 5 located at a distance of 38 miles northeast of the damsite. This event cannot be correlated with known tectonic structure and is considered to probably be related to the release of accummulated residual strain along a buried pre-Quaternary fault. The attenuation of this event to the damsite would produce a peak ground acceleration of less than 0.05g which would not produce a significant seismic impact on the dam.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and the visual inspection. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of the inspection along with data available to the inspection team.

It is also important to realize that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Mo. No Name No. 258 Dam is found to be "Seriously Inadequate". The spillway/reservoir system will accommodate about 20 percent of the PMF without overtopping the dam. If the dam is overtopped, the safety of the embankment would be in jeopardy due to the susceptibility of the embankment materials to erosion. High velocity of flow on the downstream slope of the dam could cause excessive erosion and eventually lead to a failure of the dam. The spillway system could also receive considerable damage during the occurrence of a PMF.

The overall condition of the dam and appurtenant structures appears to be fair; however, some items of concern were noted which will require attention. A quantitative evaluation of the safety of the embankment could not be made in view of the absence of seepage and stability analyses. The present embankment and appurtenant structures, however, appear to have performed satisfactorily since their construction without failure or evidence of instability. No evidence indicating that the dam has ever been overtopped was observed. The safety of the dam can only be improved if the deficiencies described in Section 3.2 are properly corrected as described in Section 7.2b.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurements, past performance and the present condition of the dam. Information on the design hydrology, hydraulic design, operation, and maintenance of the dam was not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The items recommended in Paragraph 7.2a should be pursued on a high priority basis. The remedial measures recommended in Paragraph 7.2b should be accomplished within a reasonable period of time.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

There are several options that may be considered to reduce the possibility of dam failure or to diminish the harmful consequences of such a failure. Some of these options are:

1. Increase the spillway capacity to pass the PMF, without overtopping the dam. The spillway should also be protected to prevent excessive erosion during the occurrence of the PMF.

2. Increase the height of the dam in order to pass the PMF without overtopping the dam; an investigation should also include studying the effects that increasing the height of the dam would have on the structural stability of the present embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

b. O & M Procedures

1. The erosion in the spillway approach apron caused by vehicular traffic should be repaired and the area protected to prevent future damage.

2. The spillway channel at the crest section should be leveled. A smooth transition upstream should be provided and the level condition maintained until it merges with the existing discharge channel bottom.

3. The large fill obstruction in the spillway channel should be removed to make the spillway crest the control section and a smooth transition into the spillway discharge channel provided. The downstream end of the spillway retaining wall, which is currently buried by the obstruction, should also be protected from erosion once the obstruction is removed. All disturbed areas should be stabilized and protected from erosion.

4. All trees and brush should be removed from the spillway discharge channel. The erosion gully in the channel should also be repaired and protected against further erosion.

5. The damage to the embankment due to vehicular traffic should be properly repaired and the areas protected from further damage. Vehicular traffic on the embankment should be confined to areas which are properly protected.

6. The trees and brush on the embankment slopes should be removed and regrowth prevented. An adequate, well maintained vegetative cover should be retained on the embankment slopes and in the spillway channel to protect them from erosion due to surface runoff and to prevent excessive erosion in the event the dam is overtopped or during high flows through the spillway. Removal of trees should be under the guidance of an engineer experienced in the design and construction of earth dams. Indiscriminate clearing could jeopardize the safety of the dam.

7. All burrowing animals should be eliminated from the embankment and their burrows properly backfilled and compacted.

8. The gate valve of the low-level outlet should be encased in a housing, which allows easy access to the valve and is still a deterrent to vandals. The valve should be operated periodically to ensure that the system is operable and should be properly maintained as recommended by the valve manufacturer.

9. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

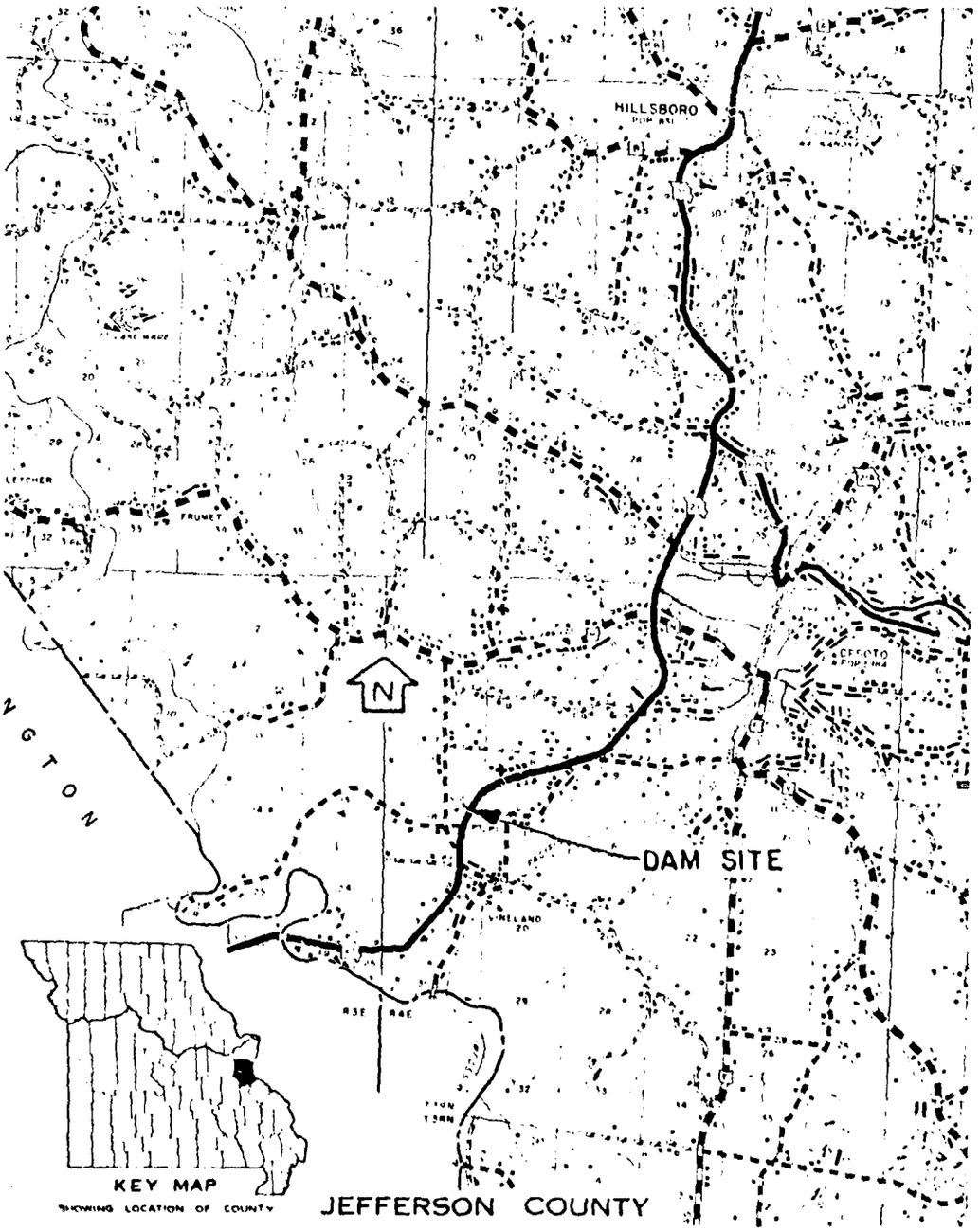
10. The owner should initiate the following programs:

    (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

    (b) Set up a maintenance schedule and log all repairs, and maintenance.

PLATES

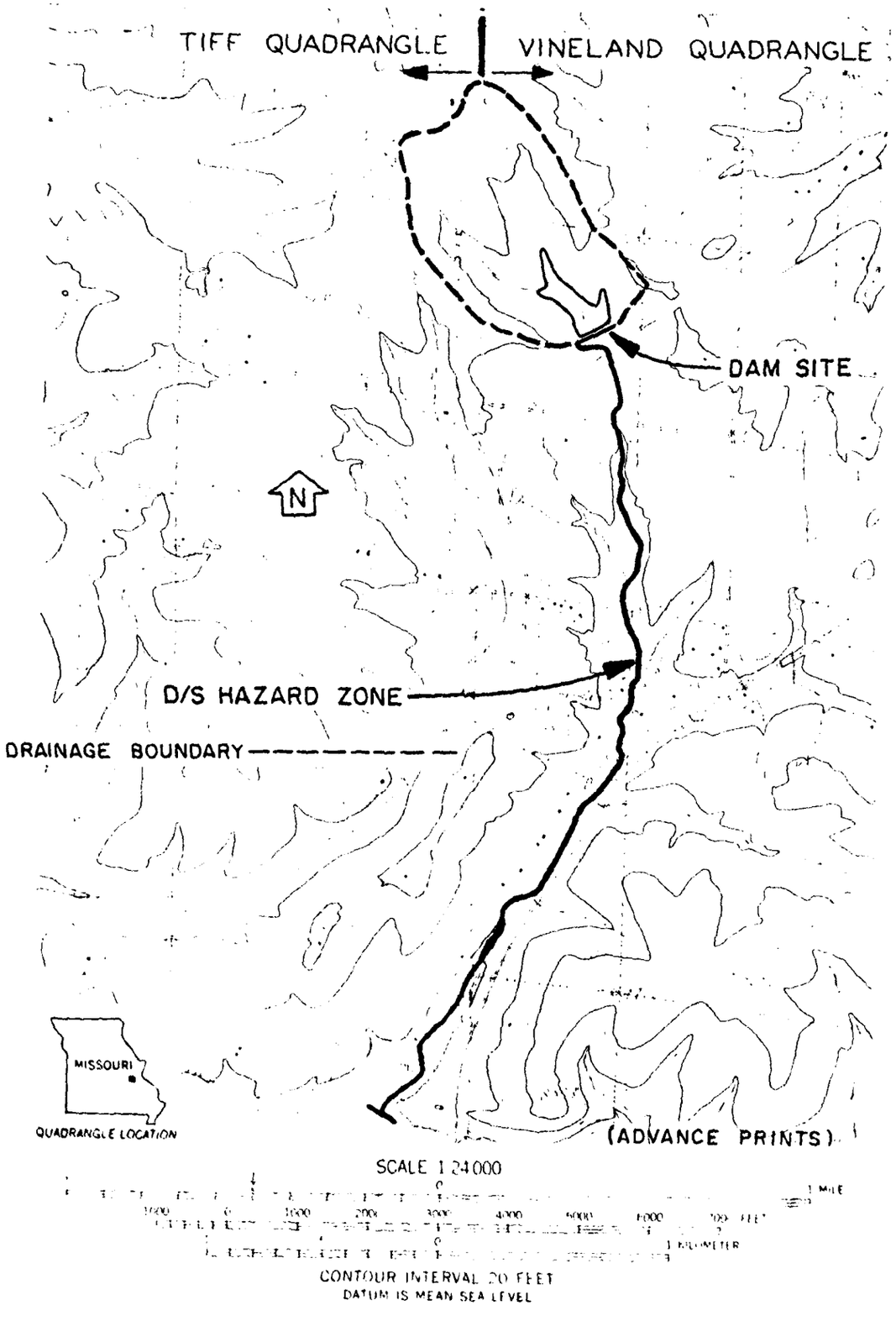
PLATE 1



LOCATION MAP - MO. NO NAME NO. 258 DAM

MO. 30455

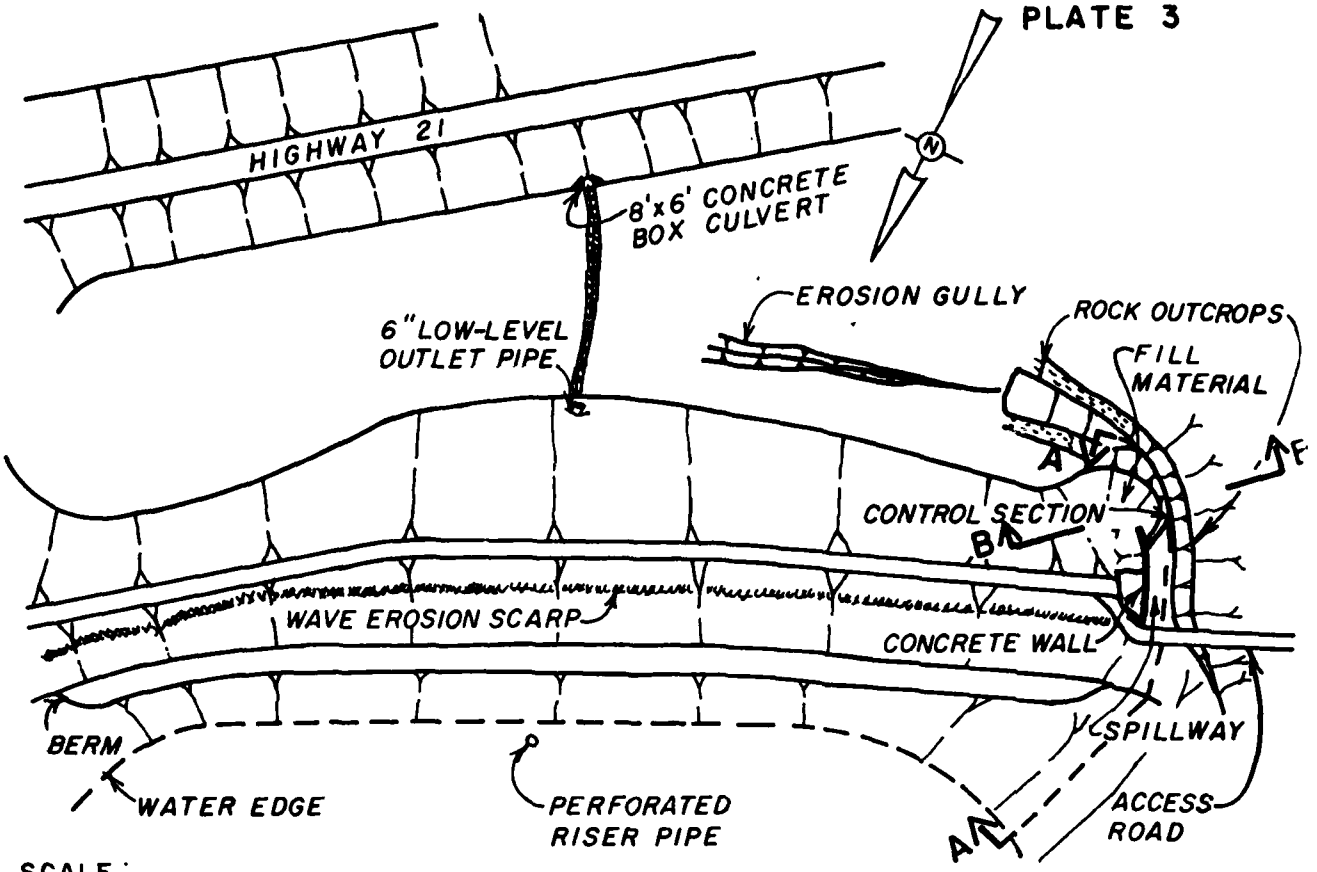
PLATE 2



MO. NO NAME NO. 258 DAM (MO. 30455)

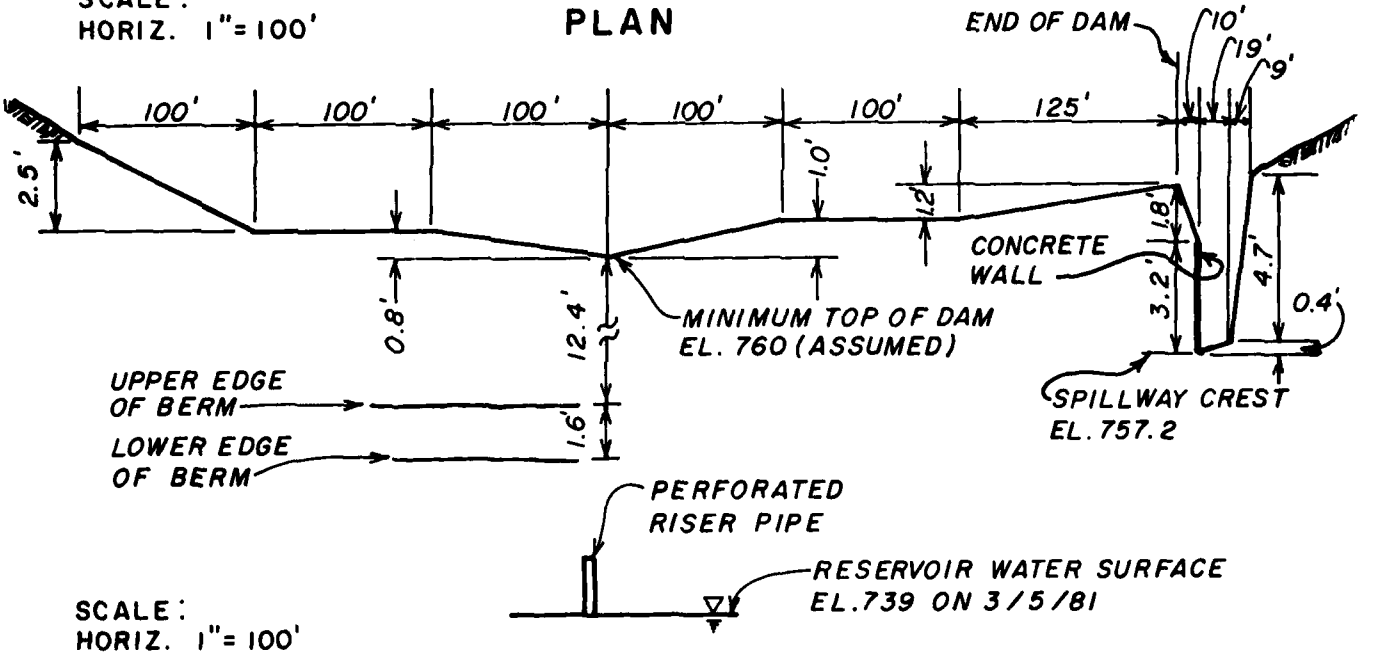
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE

PLATE 3



SCALE:
HORIZ. 1" = 100'

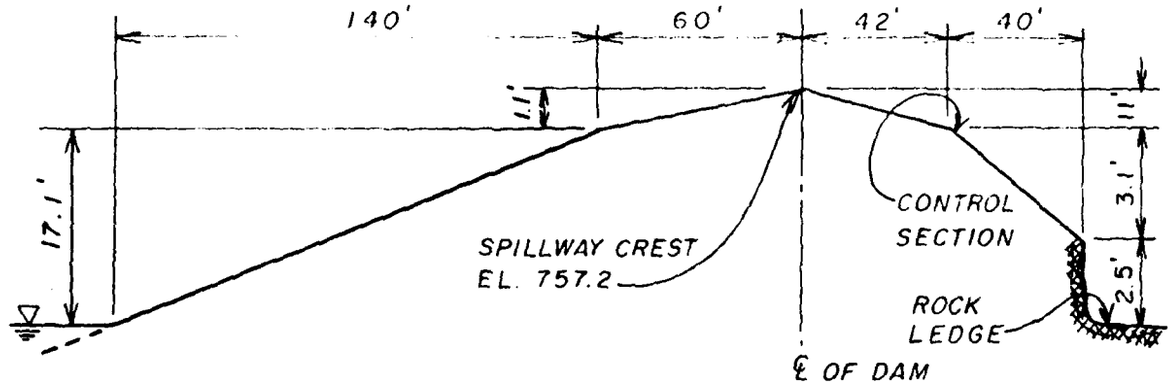
PLAN



SCALE:
HORIZ. 1" = 100'
VERT. NO SCALE

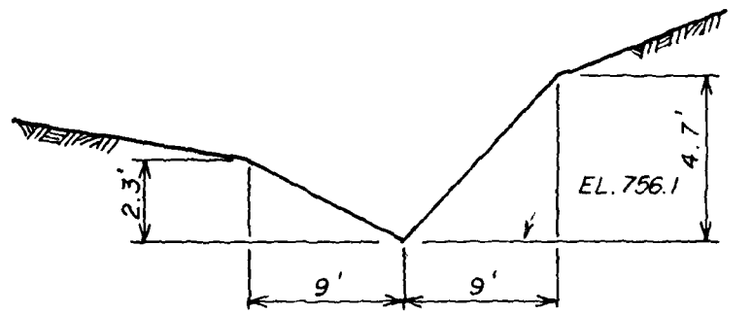
ELEVATION

MO. NO NAME NO. 258 DAM (MO. 30455)
PLAN AND ELEVATION
(SHEET 1 OF 2)



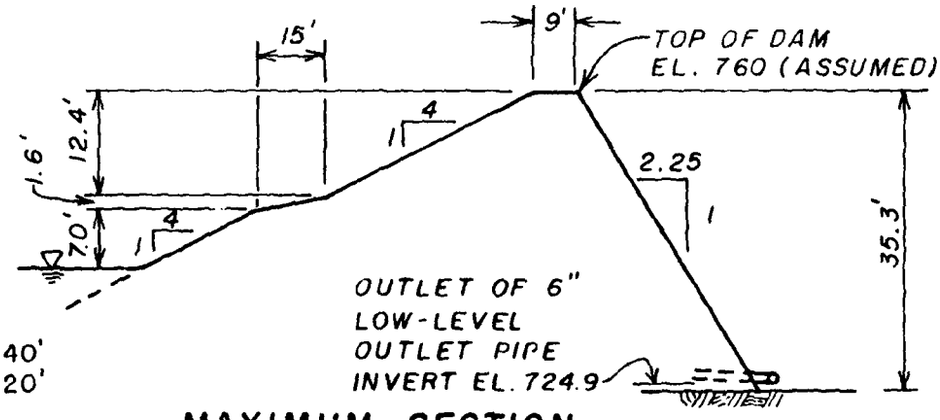
SECTION A-A
(SPILLWAY PROFILE)

SCALE:
HORIZ. 1" = 50'
VERT. NO SCALE



SECTION B-B
(SPILLWAY CONTROL SECTION)

SCALE:
HORIZ. 1" = 40'
VERT. 1" = 5'



MAXIMUM SECTION

SCALE:
HORIZ. 1" = 40'
VERT. 1" = 20'

MO. NO NAME NO. 258 DAM (MO. 30455)
SPILLWAY PROFILE, CONTROL SECTION AND
MAXIMUM SECTION
(SHEET 2 OF 2)

PLATE 5

SCALE

10 0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND FOR THIS MAP IS ON PLATES 6 THROUGH 8.

REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP OF MO. NO NAME NO.258 DAM

MO. NO NAME NO. 258DAM
PLATE 6
SHEET 1 OF 3

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
MISSISSIPPIAN	Mm	ST. LOUIS FORMATION: LIMESTONE INTERBEDDED WITH SHALE
	Mm	SALEM FORMATION: LIMESTONE INTERBEDDED WITH SHALE AND SILTSTONE
	Mo	KEOKUK- BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	UNDIFFERENTIATED CHOUTEAU GROUP: LIMESTONE
	Mk	HANNIBAL FORMATION: SHALE AND SILTSTONE

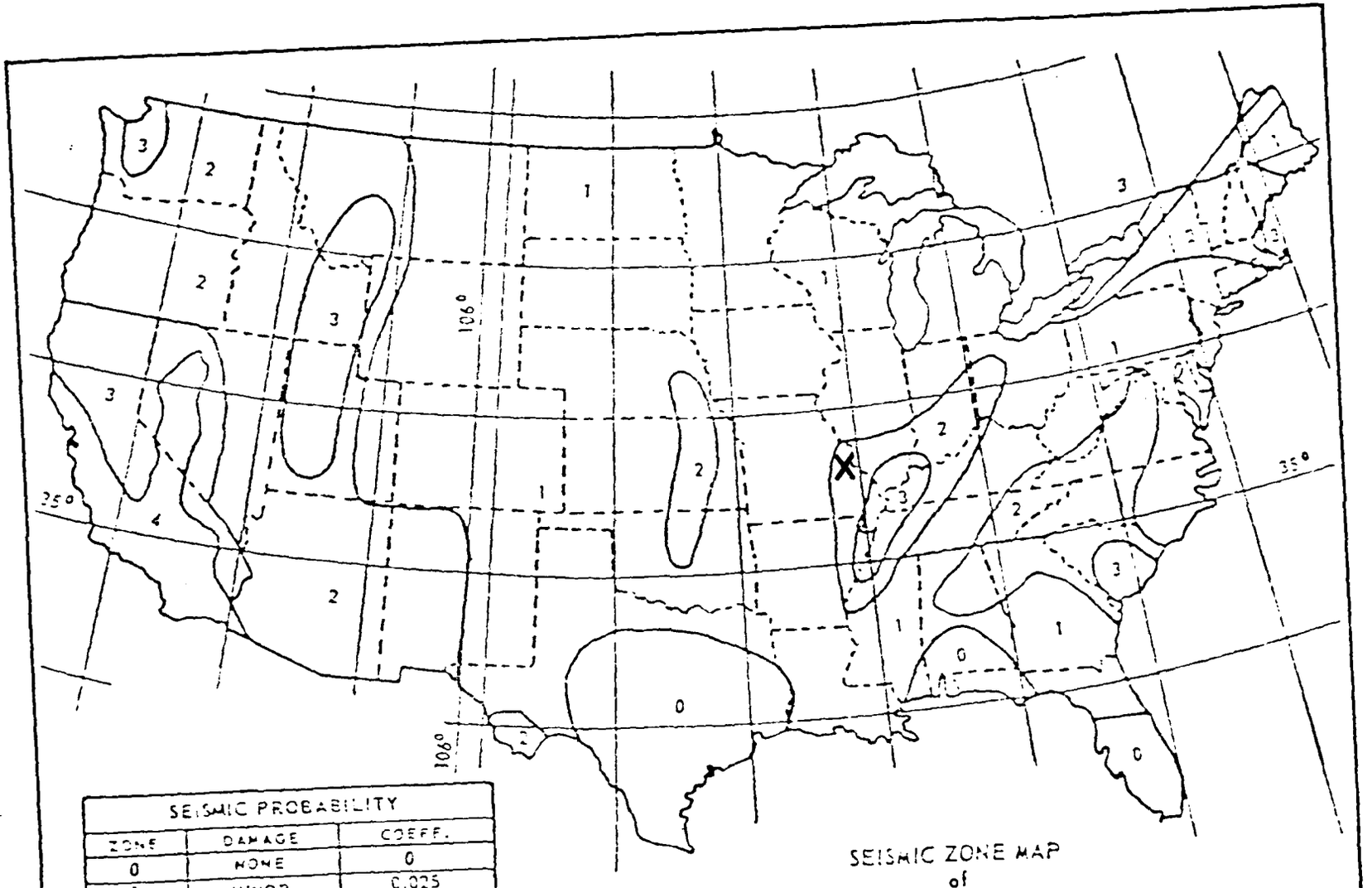
LEGEND

PERIOD	SYMBOL	DESCRIPTION
ORDOVICIAN	Ou	NOIX LIMESTONE
	Omk	MAQUOKETA SHALE, KIMMSWICK LIMESTONE
	Odp	DECORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE
	Ospe	ST. PETER SANDSTONE, EVERTON FORMATION
	Ojd	JOACHIM DOLOMITE
	Ojc	POWELL DOLOMITE, COTTER DOLOMITE
	Or	ROUBIDOUX FORMATION: INTERBEDS OF CHERTY LIMESTONE AND SANDSTONE
	Og	GASCONADE DOLOMITE

LEGEND

PERIOD	SYMBOL	DESCRIPTION
CAMBRIAN	Cep	EMINENCE DOLOMITE, POTOSI DOLOMITE
	Ceb	FRANCONIA AND BONNETERRE FORMATION: INTERBEDDED LIMESTONE, CHERTY LIMESTONE, DOLOMITE AND SILTSTONE
	Clm	LAMOTTE SANDSTONE
PRECAMBRIAN	i	ST. FRANCOIS MOUNTAINS INTRUSIVE
	v	ST. FRANCOIS MOUNTAINS VOLCANIC
	U / D	NORMAL FAULT
	U / D	INFERRED FAULT

U = UPTHROWN SIDE; D = DOWNTHROWN SIDE



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

SEISMIC ZONE MAP
of
CONTIGUOUS STATES

X APPROXIMATE LOCATION OF MO. NO NAME NO.258 DAM

PLATE 9

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

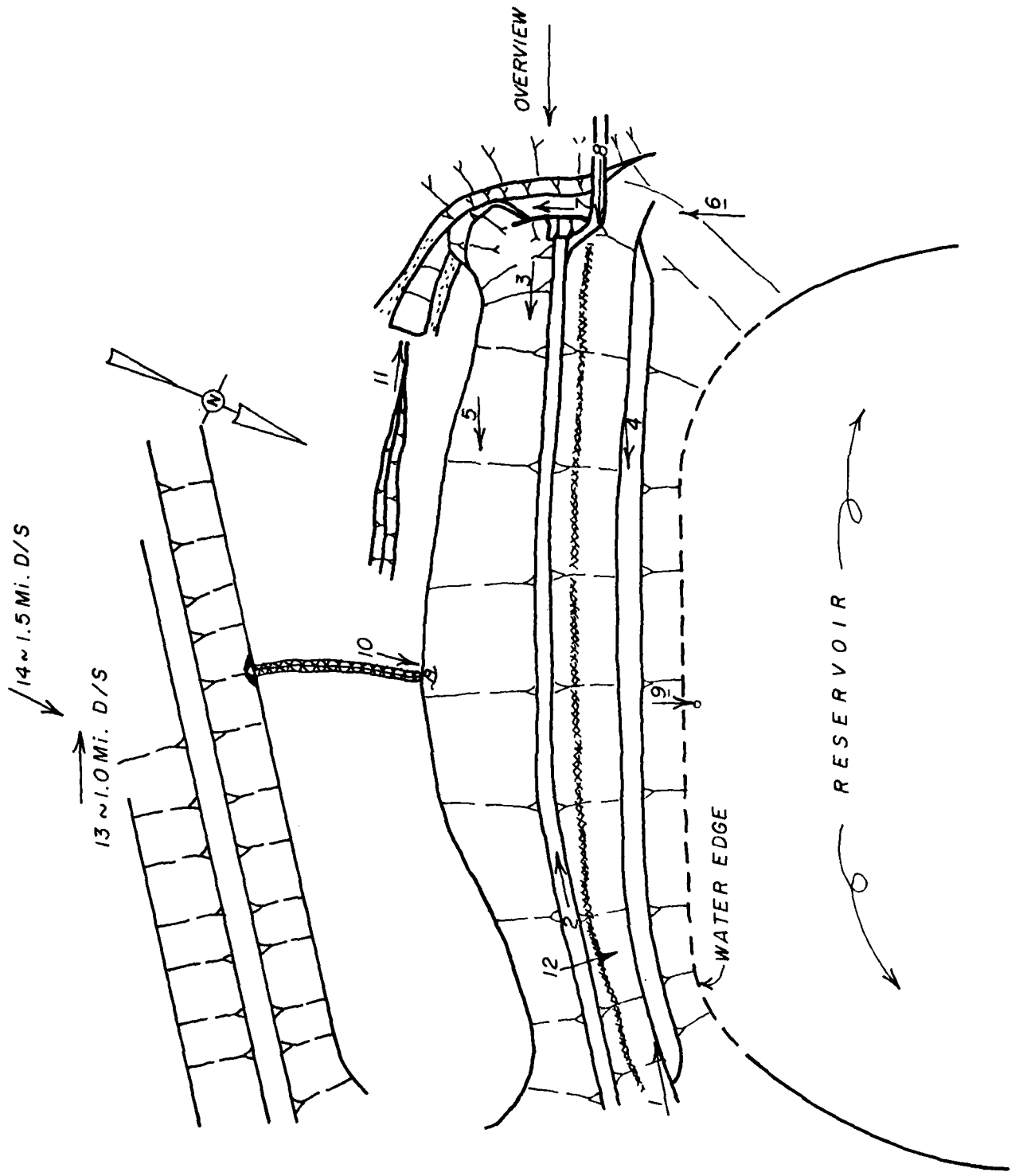


PHOTO INDEX
FOR
MO. NO NAME NO. 258 DAM

Photo 1 - View of the upstream slope from the left abutment.

Photo 2 - View of the top of dam from the left abutment.

Photo 3 - View of the downstream slope from the right abutment.

Photo 4 - Close-up view of the vehicular damage and grout cap pipes on the upstream slope.

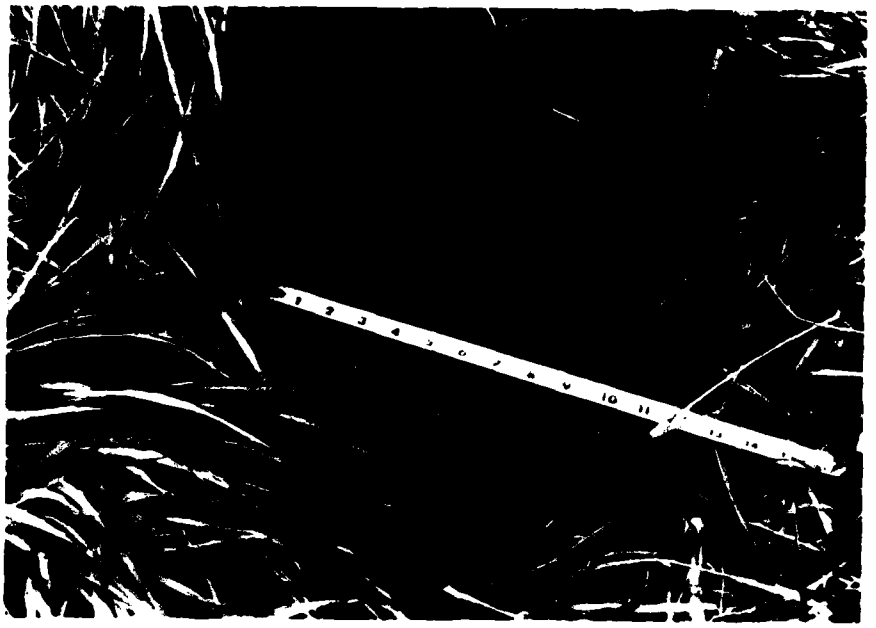


Photo 5 - Close-up view of a rodent burrow on the downstream embankment slope.

Photo 6 - View of the spillway channel inlet from the reservoir showing retaining wall and access road.

Photo 7 - Close-up view of the fill material obstruction and the erosion in the spillway channel. The spillway control section is at the right edge of the spillway channel.

Photo 8 - Close-up view of access road ascending the upstream slope to the top of dam from the spillway inlet area.

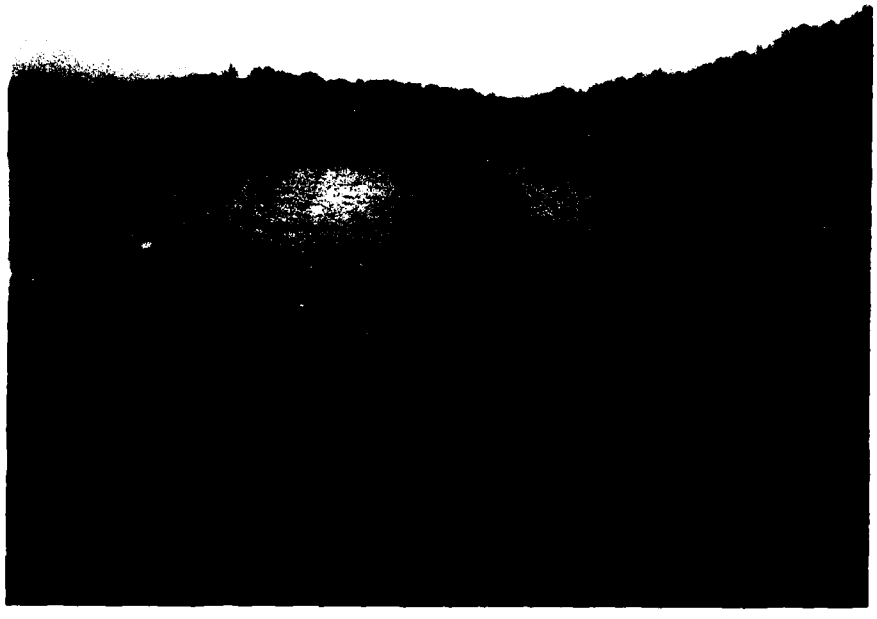


Photo 9 - Close-up view of the perforated riser pipe for the low-level outlet.

Photo 10 - Close-up view of the low-level outlet pipe at the downstream toe of the dam.

Photo 11 - Close-up view of an outcropping of thinly bedded dolomite in the spillway discharge channel.

Photo 12 - View of the reservoir and rim.

Photo 13 - View of a dwelling in the downstream hazard zone looking across the downstream channel.

Photo 14 - View of several dwellings in the downstream hazard zone looking across the downstream channel.

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MO. NO NAME NO. 258 DAM

HYDROLOGIC AND HYDRAULIC DATA, ASSUMPTIONS AND METHODOLOGY

1. SCS Unit Hydrograph procedures and the HEC-1DB computer program are used to develop the inflow hydrographs. The hydrologic inputs are as follows:

   (a) 24-hour Probable Maximum Precipitation from the Hydrometeorological Report No. 33, and 24-hour 100-year rainfall and 24-hour 10-year rainfall of Sullivan, Missouri.

   (b) Drainage area = 0.28 square miles.

   (c) Lag time = 0.14 hours.

   (d) Hydrologic Soil Group:
   Soil Group "C".

   (e) Runoff curve number:
   CN = 73 for AMC II and CN = 87 for AMC III.

2. Flow rates through the spillway are based on HEC-2 generated profiles assuming critical depth and a Manning's n = 0.035. Flow rates over the dam are based on the broad-crested weir equation $Q = CLH^{3/2}$ and critical depth assumption, in accordance with the procedures used in the HEC-1 computer program.

3. The spillway and the dam overtop rating curves are hand calculated and combined as shown on pages B-4 and B-5. This combined rating curve is input into HEC-1DB on the Y4 and Y5 cards. The $L and $V cards are, therefore, not used.

4. Floods are routed through the reservoir of Mo. No Name No. 258 Dam to determine the capability of the spillway. The impoundment of water by the highway embankment immediately downstream of the dam was considered in the preliminary stages of the hydraulic analysis and found to have no adverse affect on the spillway capacity.

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. ___ OF ___

DAM NAME: Mo No Name # 258 (Mo. 30455) — JOB NO. 1283

UNIT HYDROGRAPH PARAMETERS — BY TP DATE 4/2/81

1) DRAINAGE AREA, A = 0.28 sq. mi = (176 acres)

2) LENGTH OF STREAM, L = (1.5 " $\times \frac{2000'}{1"}$ = 3000') = 0.57 mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$H_1 = 862$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 757.2$

5) ELEVATION OF CHANNEL BED AT 0.85L, $E_{85} = 830$

6) ELEVATION OF CHANNEL BED AT 0.10L, $E_{10} = 758$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10}) / 0.75L = \frac{(830 - 758)}{(0.75)(3000)} = 0.032$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$t_c = [(11.9 \times L^3) / (H_1 - H_2)]^{0.385} = [(11.9 * 0.57^3) / (862 - 757.2)]^{0.385} = 0.23$ hr.

B) BY VELOCITY ESTIMATE,

SLOPE = 3.2% $\Rightarrow$ AVG. VELOCITY = 3 ft/sec

$t_c = L/V = (3000 \text{ ft}) / (3 \text{ ft/sec}) * (3600 \text{ sec/hr}) = 0.28$ hrs.

USE $t_c = 0.23$ hrs.

9) LAG TIME, $t_l = 0.6\, t_c = 0.14$ hrs.

10) UNIT DURATION, $D \leq t_l / 3 = 0.05$ hr. < 0.083 hr.

USE $D = 0.083$ hr.

11) TIME TO PEAK, $T_p = D/2 + t_l = \left(\frac{0.083}{2}\right) + 0.14 = 0.18$ hr.

12) PEAK DISCHARGE,

$q_p = (484 \times A) / T_p = \frac{(484 * 0.28)}{0.18} = 753$ cfs

ECI-1 **PRC ENGINEERING CONSULTANTS, INC.**

Missouri Dam Safety — SHEET NO. ____ OF ____

Mononame # 258 (Mo. 30455) — JOB NO. 1283

Reservoir Surface Area : Reservoir Elevation — BY TP — DATE 4/1/81

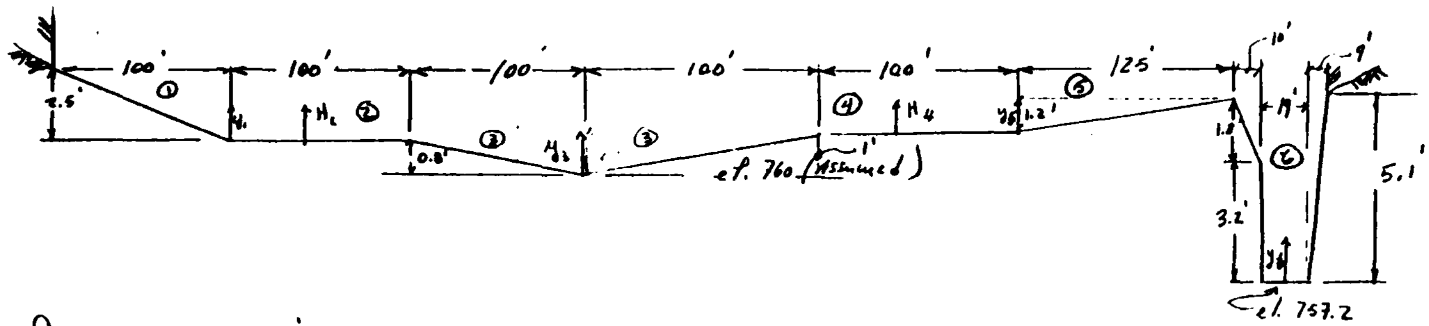
Reservoir Elevation (NGVD)	Surface Area (acres)	Remarks
730	0.0	Assumed streambed elevation
740	1.5	Interpolated
750	4.5	Interpolated
757.2	8.5	Spillway crest elevation
760	21.5	Minimum Top of Dam (assumed)
770	40.0	Interpolated.
780	53.5	Measured from Tiff and Vineland, Mo., 7.5' series Quads.

ECI-4 PRC ENGINEERING CONSULTANTS, INC.

Missouri Dam Safety Inspection — SHEET NO. ____ OF ____

MoNoname #258 (Mo. 30455) — JOB NO. 1283

Spillway and dam overtop rating curves — BY TP — DATE 4/2/8



Section ① $y_1 \le 2.5'$ $y_1 = \frac{4}{5} H_2$, $H_2 = WSEL - 760.8$, $A_1 = \frac{100}{2.5}\frac{y_1^2}{2}$, $T_1 = \frac{100}{2.5} y_1$

$y_1 > 2.5'$ $y_1 = \frac{2}{3}\left(H_2 + \frac{2.5}{4}\right)$, $A_1 = 100\left(y_1 - \frac{2.5}{2}\right)$, $T_1 = 100'$

Section ② for all H_2 $Q_2 = CLH_2^{3/2}$, $L = 100'$, $H_2 = WSEL - 760.8$

Section* ③ for $y_3 \le 0.8'$ $A_3 = y_3\left(y_3 \cdot \frac{m_1 + m_2}{2}\right)$, $m_1 = \frac{100}{0.8}$, $m_2 = \frac{100}{1}$, $T_3 = 2 y_3\left(\frac{m_1 + m_2}{2}\right)$

$0.8' < y_3 \le 1'$ $A_3 = y_3\left(100 + \frac{100 y_3}{(2)(1)}\right) - \frac{(100)(0.8)}{2}$, $T_3 = 100 + \frac{100 y_3}{(1)}$

$y_3 > 1'$ $A_3 = y_3 T - \left(\frac{(100)(1) + (100)(0.8)}{2}\right)$ $T_3 = 200$, $WSEL = 760 + y_3 + V_3^2/2g$

B-4

Section ④ for all H_4 $Q_4 = CLH_4^{3/2}$, $L = 100'$, $H_4 = WSEL - 761$

Section* ⑤ $y_5 \le 1.2$ $y_5 = \frac{4}{5} H_4$, $H_4 = WSEL - 761$, $A_5 = \frac{125}{1.2}\frac{y_5^2}{2}$, $T_5 = \frac{125}{1.2} y$

$y_5 > 1.2$ $y_5 = \frac{2}{3}\left(H_4 + \frac{1.2}{4}\right)$, $A_5 = 125 y_5 - 75$, $T_5 = 125'$

Section ⑥ Refer to HEC-2 Printout, $WSEL = 757.2 + y_6 + V_6^2/2g$

HEC-2 used to generate backwater profile from control section to axis of embankment

* Note: Critical depth assumed, $V_c = \sqrt{g\frac{A}{T}}$, $Q = VA = \sqrt{g\frac{A^3}{T}}$

ECI-4 PRC ENGINEERING CONSULTANTS, INC.

Missouri Dam Safety Inspection — SHEET NO. ____ OF ____

MoNoname #258 (Mo. 30455) — JOB NO. 1283

Spillway and dam overtop rating curve — BY TP — DATE 4/2/8

WSEL (NGVD)	y_1	A_1	T_1	V_1	Q_1	H_2	C_2	Q_2	y_3	A_3	T_3	V_3	Q_3	H_4	C_4	Q_4	y_5	A_5	T_5	V_5	Q_5
757.2																					
757.87																					
758.33																					
758.68																					
758.98																					
759.23									0	0	0	0	0								
760.27									0.22	5.45	49.5	1.88	10.2	0	0	0	0	0	0	0	0
761.10	0.24	1.15	9.6	1.97	2.26	0.3	2.97	48.8	0.87	84.8	187.	3.82	324.3	0.1	2.92	9.23	0.08	0.33	8.33	1.13	0.38
761.81	0.81	13.06	32.32	3.61	47.09	1.01	3.033	308	1.36	182	200	5.4	985	0.81	3.03	221	0.65	21.9	67.5	3.2	70.6
762.43	1.3	34.	52.2	4.6	156	1.63	3.069	639	1.77	264	200	6.5	1721	1.43	3.048	521	1.14	68.2	119.2	4.3	293
763.00	1.76	62.	70.4	5.3	330	2.20	3.083	1006	2.16	342	200	7.4	2538	2.0	3.08	871	1.53	116.7	125.	5.5	640
763.54	2.19	96.	87.7	5.9	571	2.74	3.09	1401	2.51	412	200	8.1	3356	2.54	3.09	1250	1.89	161.7	125.	6.5	1043
764.05	2.58	133.	100.	6.6	874	3.25	3.09	1810	2.85	480	200	8.8	4220	3.05	3.09	1646	2.23	204.2	125.	7.3	1481
764.54	2.91	166.	100.	7.3	1214	3.74	3.09	2235	3.18	546	200	9.4	5119	3.54	3.09	2058	2.56	245.	125.	7.9	1946
765.02	3.23	198.	100.	8.0	1581	4.22	3.09	2679	3.50	610	200	9.9	6045	4.02	3.09	2491	2.88	285.	125.	8.6	2442

WSEL (NGVD)	y_6	A_6	T_6	V_6	$V_6^2/2g$	Q_6	Q_{TOTAL}
757.2	0	0	0	0	0	0	0
757.87	0.63	12.4	20.12	1.61	0.04	20.	20.
758.33	1.07	21.39	20.89	1.87	0.05	40.	40.
758.68	1.41	28.77	21.51	2.09	0.07	60.	60.
758.98	1.69	34.70	21.99	2.31	0.08	80.	80.
759.23	1.94	40.06	22.41	2.50	0.10	100.	100.
760.27	2.92	63.01	24.16	3.17	0.16	200.	210.
761.10	3.70	83.38	28.39	3.60	0.20	300.	685.
761.81	4.39	104.17	33.32	3.84	0.23	400.	2032.
762.43	4.99	125.54	37.72	3.98	0.25	500.	3830.
763.00	5.54	146.55	38.00	4.09	0.26	600.	5985.
763.54	6.06	166.42	38.00	4.21	0.27	700.	8321.
764.05	6.56	186.36	38.00	4.32	0.29	800.	10831.
764.54	7.04	203.5	38.00	4.42	0.30	900.	13472.
765.02	7.51	221.10	38.00	4.52	0.32	1000.	16238.

← Refer to HEC-2 Printout SECNO 2 →

HEC-2 INPUT AND SUMMARY TABLE

```
**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
  ENGON CODE =  31.02.03.04
  MODIFICATION =  50.10.52.54
**************************************************

T1       MISSOURI DAM SAFETY
T2       SPILLWAY RATING CURVE
T3       PROGRAM NO. 25

J1  ICHECK     INQ        NRUN       IDIR       STRT       METRIC     HVINS      G          WSEL       FQ

          -1.        2.         0.         0. -1.0E-0000      0.00       0.0        0.    757.500      0.001

J2  NPROF      IPLOT      PRFVS      XSECV      ASECH      FN         ALLEC      IBW        CHNIM      ITRACE

          1.0E-0     0.0E-0    -1.0E-00    0.00E-0    0.000      0.000      0.000      0.000      0.000      0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

          3.0E-0     0.00.     3.0E-0     0.0E-00    36.000     10.000     42.000     3.000      5.000      17.000

J4  LRECL      NUMSEC                    ********REQUESTED SECTION NUMBERS********

          -1.0E-0    -1.0E-0    0.0E-0     1.0E-0     0.000      0.000      0.000      0.000      0.000      0.000
NC        .033       .030       .033       .100       .200       0.000      0.000      0.000      0.000      0.000
X1        14.000     25.0E-0    5.0E-0     0.0E-0     0.0E-0     100.000    200.000    300.000    400.000    500.000
XT        5.0E-00    730.E-1    0.0E-0     0.0E-00    1000.000   0.000      0.000      0.000      0.000      0.000

X1        1.000      5.000      0.0E-0     14.000     0.000      0.000      0.000      0.000      0.000      0.000
GN        756.400    0.000      756.100    0.000      760.000    10.000     0.000      0.000      0.000      0.000

X1        0.000      7.000      0.000      38.000     42.000     42.000     42.000     0.000      0.000      0.000
GN        772.200    0.000      762.200    0.000      760.420    10.000     757.200    10.000     757.200    29.000
XR        762.300    38.000     772.300    38.000     0.000      0.000      0.000      0.000      0.000      0.000
FQ        0.000      0.000      0.000      0.000      0.000      0.000      0.000      0.000      0.000      0.000
```

****
HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
ERROR CORR - 81.02.03.04
MODIFICATION - 79.10.22.55.54
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

PROGRAM SG. ...

SUMMARY PRINTOUT

	SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	10K*S	K*XNCH
*	1....	1.03	9.42	7.18	4.52	.32	20.00	757.65	172.45	30.00
*	1....	1..	7.71	9.48	5.19	.42	40.00	758.14	156.92	30.00
*	1....	1..	1..76	11.23	..54	.48	60.00	758.50	145.20	30.00
*	1....	2.15	13.44	12.52	5.95	.55	80.00	758.80	142.58	30.00
*	1....	2..	15.03	13.49	4.24	.60	100.00	759.05	137.50	30.00
*	1....	3..	20.19	14.86	7.04	.91	200.00	760.07	130.07	30.00
*	1....	3....	25.41	16.01	5.47	1.11	300.00	760.67	125.60	30.00
*	1....	4.15	29.49	16.95	9.20	1.31	400.00	761.56	123.21	30.00
*	1....	4....	31.64	17.84	4.68	1.46	500.00	762.17	119.41	30.00
*	1....	4....	34.09	18.00	13.33	1.65	600.00	762.73	121.98	30.00
*	1....	5.42	44.39	1....	17.87	1.99	700.00	765.26	122.75	30.00
*	1....	5....	7....	19.00	11.34	2.00	800.00	763.77	122.92	30.00
*	1....	6....	7....	1....	11.75	2.14	900.00	764.25	122.72	30.00
*	1....	6.30	81.82	19.03	12.22	2.32	1000.00	764.72	125.52	30.00
	2....	....	12.40	29.12	1.61	.04	20.00	757.47	21.32	30.00
	2....	1..	21.59	....	1.87	.05	40.00	758.33	15.32	30.00
	2....	1.41	25.77	31.51	2.09	.17	60.00	758.68	13.39	30.00
	2....	1.69	30.70	31.99	2.31	.18	80.00	758.98	13.34	30.00
	2....	1.44	49.06	32.41	2.50	.10	100.00	759.25	13.44	30.00
	2....	2.32	63.01	24.15	5.17	.16	200.00	760.27	13.82	30.00
	2....	3.70	83.58	24.39	3.60	.20	300.00	761.10	15.09	30.00
	2....	4.51	104.17	35.32	5.84	.25	400.00	761.81	15.54	30.00
	2....	4.99	125.54	37.72	5.48	.25	500.00	762.43	15.20	30.00
	2....	5.54	146.55	38.08	4....	.26	600.00	763.00	13.60	30.00
	2....	6.36	166.42	38.00	4.21	.27	700.00	763.54	12.51	30.00
	2....	6.56	185.36	38.00	4.32	.29	800.00	764.05	11.75	30.00
	2....	7.06	205.66	38.00	4.42	.30	900.00	764.54	11.19	30.00
	2....	7.51	221.18	38.70	4.52	.32	1000.00	765.02	10.75	30.00

SUMMARY OF ERRORS

CAUTION SECNO= 1.[illegible] PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE= 9 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE=10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE=11 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE=12 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE=13 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.[illegible] PROFILE=14 CRITICAL DEPTH ASSUMED

SUMMARY OF PMF AND ONE-HALF PMF ROUTING

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1                    MISSOURI DAM SAFETY
    2                A2                    MONONAME # 258
    3                A3                 PMF AND 50 PERCENT PMF
    4                B    300      0       5       0       0       0       0       0       0       0
    5                B1     5
    6                J      1      2       1
    7                J1     1     .5
    8                K        DA MONO
    9                K1     RUNOFF CALCULATION FOR MONONAME # 258 DRAINAGE AREA
   10                M      1      2     .28             .28       1                               1
   11                P            25.7     100     120     130
   12                T                                                       -1      -87
   13                W2           .14
   14                X                     1
   15                K      1  MONODA
   16                K1     ROUTE HYDROGRAPH THROUGH MONONAME # 258 DAM
   17                Y                             1       1
   18                Y1     1                                       -757.2      -1      1
   19                Y4  757.2   757.9   758.3   758.7     759   759.2   760.3   761.1   761.8   762.4
   20                Y4    763   763.5   764.1   764.5     765
   21                Y5      0      20      40      60      80     100     210     685    2032    3830
   22                Y5   5985    8321   10831   13472   16238
   23                $A      0     1.5     4.5     8.5    21.5     40.    53.5
   24                $E    730     740     750   757.2     760     770     780
   25                $S  757.2
   26                $D    760
   27                K      99
```

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	757.20	757.20	760.00
STORAGE	80.	80.	120.
OUTFLOW	0.	0.	180.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	762.11	2.11	169.	2957.	6.58	15.75	0.00
.50	761.38	1.38	152.	1233.	4.42	15.83	0.00

PERCENT OF PMF ROUTING
EQUAL TO SPILLWAY CAPACITY

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                 A                    MISSOURI DAM SAFETY
    2                 A2                   MONONAME # 258
    3                 A3       PERCENT PMF
    4                 B    300        0        5        0        0        0        0        0        0        0
    5                 B1     5
    6                 J      1        4        1
    7                 J1   .15      .20      .25      .30
    8                 K        DA MONO
    9                 K1       RUNOFF CALCULATION FOR MONONAME # 258 DRAINAGE AREA
   10                 M        1        2      .28                .28        1                                 1
   11                 P                25.7      100      120      130
   12                 T                                                                          -1      -87
   13                 W2               .14
   14                 X                                  1
   15                 K        1  MONODA
   16                 K1       ROUTE HYDROGRAPH THROUGH MONONAME # 258 DAM
   17                 Y                                           1        1
   18                 Y1       1                                                          -757.2      -1
   19                 Y4   757.2    757.9    758.3    758.7      759    759.2    760.3    761.1    761.8    762.4
   20                 Y4     763    763.5    764.1    764.5      765
   21                 Y5       0       20       40       60       80      100      210      685     2032     3830
   22                 Y5    5985     8321    10831    13472    16238
   23                 $A       0      1.5      4.5      8.5     21.5     40.     53.5
   24                 $E     730      740      750    757.2      760      770      780
   25                 $$   757.2
   26                 $D     760
   27                 K       99
```

SUMMARY OF DAM SAFETY ANALYSIS

1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	757.20	757.20	760.00
	STORAGE	80.	80.	120.
	OUTFLOW	0.	0.	180.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.15	759.50	0.00	110.	130.	0.00	16.17	0.00
.20	759.97	0.00	120.	177.	0.00	16.17	0.00
.25	760.37	.37	128.	254.	2.33	16.08	0.00
.30	760.64	.64	134.	413.	2.75	16.00	0.00